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The General Practitioner as a Clinical Epidemiologist: Three Metaphors to Explain the Fundamental Concepts

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Research Article

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Abstract

In this article, based on metaphors, we review the mechanisms of applying some concepts of clinical epidemiology in general medicine: 1) The general practitioner (GP) as a magician: he uses clinical epidemiology as a strategy to handle diagnostic uncertainty, but also many other techniques ("tricks of the magician"), which are qualitative techniques, such as contextualization and others; 2) The GP as a fisherman with a hook: the GP performs "fishing with hook" ("case–finding"), since in general medicine the predictive negative value (the probability that a certain disease is not the cause of patient's problem) is more important than the predictive positive value, due to the low prevalence of disease versus the hospital context. In addition, GP should take individual decisions based on Bayesian probabilities, rather than relying on the frequency probabilities On the other hand, the statistical significance of some intervention does not always mean clinical significance and, vice versa. The GP focuses on the effectiveness ("fishing with a hook"), compared to the efficacy ("net fishing"); and 3) The GP as a lawyer: for the hospital doctor, the patient "is guilty" (does not matter to have a mistake and to call guilty or sick to a healthy patient). From an epidemiological point of view, he/she does not mind incurring a type I error: it giving for true a false positive; so giving more value to the test positive, although it may be false. However, from point of view of the lawyer, and the GP, the individual is innocent until proven otherwise; they prefer to err by calling "not guilty", instead to have a fault in reverse, that is, they prefers to incur the type II error: it taking as true a false negative. For the GP, clinical knowledge is a way of understanding a set of facts. The GP and epidemiologist complement each other, but each one makes his own tune.

Keywords: Clinical Epidemiology; General Practice; Medical Diagnosis; Medical Education; Bayes' theorem; Probability; Risk; Metaphors.

Introduction

Epidemiology is the backbone of medical research. Clinical Epidemiology is rapidly emerging as a new domain in modern medicine. Clinical epidemiology constitutes a bridge between epidemiology and clinical and can be defined as a science in which "epidemiological principles and methods" are applied to the problems found in clinical medicine [1–3].

Clinical epidemiology is characterized by the conjunction of epidemiology methods for the purposes of clinical care activity, that is, a good diagnosis and treatment of patients. Some of the definitions proposed by different authors would be [4]:

1) For Feinstein, clinical epidemiology is the framework or architecture of clinical research, so that information is obtained to guide clinical decisions
2) For Weiss it is the study of the consequences of the disease
3) For Fletcher it is the application of the principles and methods of epidemiology to the solution of the problems found in clinical medicine. As such science it deals with the count of clinical phenomena in humans and uses epidemiological methods to perform such a count and analyze its results
4) Finally, Sackett qualifies to clinical epidemiology as a basic science of clinical medicine

Clinical epidemiology focuses on the study of events ranging from the onset of the disease to its outcome in the form of cure, sequelae or death. Therefore, the study subjects are ill, who are usually in the clinic, and their contributions are relevant especially for the diagnosis and secondary and tertiary prevention of the disease [4–6].

The fundamental purpose of clinical epidemiology is to develop and apply clinical observation methods that lead to valid

clinical conclusions and more appropriate decision making. In addition to the aspects of diagnosis, prognosis and treatment related to a particular patient, clinical epidemiology provides the necessary knowledge to be able to perform a "critical analysis" of the scientific literature, increase the investigative capacity of doctors and other health professionals, and deepen aspects related to social sciences and health economics. Clinical epidemiology, applying the terms of normality / abnormality, sensitivity and specificity of diagnostic tests, predictive values and risk estimation, to name a few, would allow the physician to make a better decision and use the most effective treatment alternative for the patient [2, 4].

That is, clinical epidemiology has its main element in the solution of the treatment and management of diseases, contributing to the identification of risk factors for certain diseases and to date being the fundamental part of Evidence–Based Medicine. So, it becomes important the teaching of clinical epidemiology to help in the education of professionals to get a judicious capacity and the rational use of the best alternatives in diagnosis and treatment, through a critical evaluation of the literature, and help stimulate the training of researchers, because it is implicit that the execution of clinical epidemiology will lead to the development of research [7].

However, "Clinical Epidemiology" is a term that most doctors do not listen to during their professional training and that becomes more necessary when we have the responsibility for care and decision making with patients [2]. In addition, the conceptual development of clinical epidemiology has not been accompanied by a parallel development in the practice of general medicine. On the other hand, although the concepts of clinical epidemiology are taken from general epidemiology, the characteristics of general medicine can make its practical application more complex [8, 9], including its specific contribution to the COVID–19 pandemic, where it could be a tool for a greater understanding of the population's thinking beyond academic and professional circles [10].

Therefore, it is logical that the concepts and theories that pertain to the application of clinical epidemiology in general medicine are often difficult to explain and understand. One way to explain these concepts is through metaphors. Metaphors enable us to understand something that is unknown in terms of its familiarity. For this reason, they are used frequently in all sciences that adopt common words to name complex realities. The metaphors are analogue devices, used to illuminate reality. Metaphors can simplify expert knowledge, not by ignoring or reducing the inherent complexity, but by providing a point of entry for its comprehension. They are a means of generating ideas, promoting creativity, and constructing concepts and theories. Thinking based on metaphors and comparisons is a way of transforming a concept into something that is so suggestive, interesting, and surprising, that it reaches people more easily. Metaphorical reasoning may support the inclusion of marginalized perspectives in the application of clinical epidemiology in general medicine [11–18].

In this context, this article has as aims, through the use of metaphors, reflect, conceptualize and systematize some elements of clinical epidemiology, in its application in general medicine.

Method

This article is a personal view. It is based on an unsystematic or opportunistic search for information considering the bibliographic references of selected articles, reviews of books related to the topic, and the experience and opinion of the author.

Discussion

Clinical epidemiology is based on the tripod: 1) The diagnosis of certainty of the individual clinic; 2) The laboratory; and 3) The statistics (Figure 1). Clinical epidemiology offers a broad overview of the likely behavior of certain situations or characteristics of clinical work in large groups of patients. Their contributions are very useful, but they do not meet the needs of individual attention in the face of the new, unique case, and despite all the information available, there will always be a degree of uncertainty; The patient will have a certain clinical form of the disease, evolutionary peculiarities, infrequent manifestations, rare complications, personal response to the treatment, and also the personal and social peculiarities of that patient.

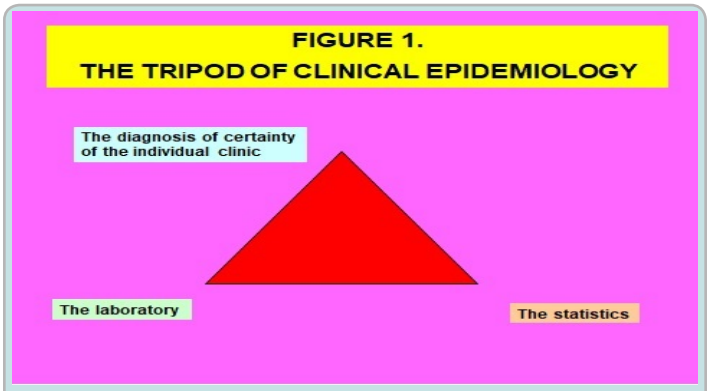

Figure 1: The Tripod of Clinical Epidemiology.

Clinical epidemiology and individual care are not separated, but complement each other. From the development of clinical epidemiology, the need for quantitative information in the literature became evident, with the aim of reducing uncertainty in the decision–making process of patients. This is not a qualitative change, since clinicians were already taking personal experience and the contributions of medical literature as sources of reference. That is to say, it is not a paradigm shift; it is then more of a quantitative problem (Figure 2). Uncertainty for decisions will always remain, even if their limits could be reduced [19–21].

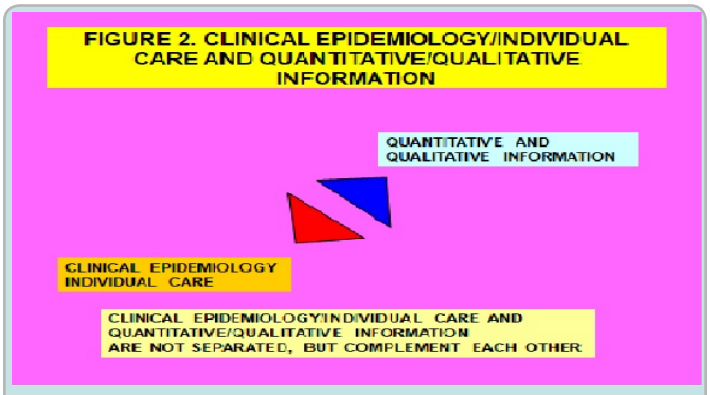

Figure 2: Clinical Epidemiology/Individual Care and Quantitative/Qualitative Information.

Medical humanities, narratives and metaphors deserve more attention in education, training and clinical care of general practitioners (GPs). Throughout history, the metaphor has been used as a teaching mechanism and engine for changing ideas and behaviors. The philosophers and prophets, from Plato to Voltaire; from Jesus to Buddha, they have also known the strength and power of metaphors. In this way, its use in the clinical physician as a method of learning and behavior change should not be surprising [22].

The nature and importance of clinical epidemiology (as with other clinical medicine topics, such as, for example, the severity of respiratory disease, etc.), are usually expressed with mathematical measures such as proportions, rates, reasons, or risks (How others biomedical measures they are used in other areas of clinical medicine, such as lung function, x–rays, blood tests and other physiological characteristics). However, the use of narratives, stories, fables or metaphors, as well as other materials typical of the humanities, such as novels, poems, movies, music and paintings, can represent a rich and experimental understanding of clinical epidemiology for the GP. More generally, narrative health psychology, narrative medicine and medical humanities deserve more attention in education, training and clinical care from GPs, medical students and other health professionals [23–25].

The analogy between a certain phenomenon observed in a certain artistic or scientific field and a certain phenomenon pending understanding and observed in general medicine is an important support to understand the latter. Metaphors are analogical devices to illuminate reality. Metaphors are a type of model; but, like all models, they have limitations and should be used carefully [26].

The vision of that rigorous method of the physical sciences is necessary and adequate for all aspects of human tasks is called "scientificism." And the attitude that metaphorical thinking is suspicious, which is inherently less reliable than non–metaphoric thinking, is one of the worst forms of scientism [26]. The problem with the rigorous and formal approach of mathematical language to try to give meaning to things is that we cannot expect that rigor to shed light on the meaning of meaning. New metaphors have always been crucial for all progress. A new metaphor is a truly profound occurrence in nature. It means that in relation to that for which we use the metaphor, it has become a new thing. That literally means there is something new in the world [26, 27].

Based on three metaphors, we review the mechanisms of the mental operation of applying some concepts of clinical epidemiology in general medicine. These three metaphors of the GP's work as a clinical epidemiologist are:

The GP as a wizard

The GP sees a patient in ten minutes, during which time a diagnosis is made and treatment is performed. For a novice observer, such as a medical student or a resident, this is incomprehensible, it's magic! It's like pulling a rabbit out of the hat. However, we need to know the trick if we are to be able to repeat it. How does the GP make these diagnoses appear or disappear and how does he/she guess the thoughts of the patient? Maybe he/she studies the stars and reads crystal balls?

The meaning of “art” or “clinical expertise” is associated with the ability or capacity to manage the uncertainty of the problem. Trying to negate the “old” concept of “clinical eye of the wise physician” (subjectively) to emphasize clinical epidemiology (objectively) as a unique approach is a mistake in the development of the GP.

The clinical emerges, that is, it is perceived by the clinician within a theoretical framework that clarifies the reality. From that moment, there are a number of clinical strategies to manage the uncertainty of decision–making: the internal consistency of the doctor, congruence with other stakeholders, the internal consistency of semiotics, and temporal consistency. Each of these strategies has a number of clinical techniques.

From the paradigm of positivist science (quantitative, objective) the clinician primarily uses clinical strategies to manage uncertainty, clinical epidemiology, and evidence based medicine. But many other techniques are frequently used. These techniques are the “tricks of the magician” and they are qualitative techniques. Table 1 presents these tools of the GP that are the “tricks of the magician.” The GP is a magician in the sense of being wise, that is, someone with the ability to see what others do not see, to feel what, for most people, passes unnoticed—the trick is to use these powerful subjective tools [28–31].

Table 1: Tools of the GP as “Tricks of the Magician”.

Tools of the GP As “Tricks of the Magician”	
1	Contextualization
2	Experience
3	Continuity of care
4	Common sense
5	Strategic planning
6	Use of resources and strengths
7	Self esteem and self–efficacy
8	Emotion and intuition
9	Ethics
10	Participation of patients and communities
11	Use of our senses
12	The test of time
13	Compassion
14	Ecological and networked relations
15	Focusing on the process rather than the outcome
16	Clinical interview and empathy
17	Efficiency and effectiveness
18	Creativity

The GP as a fisherman with a hook

Confucius said that “the Master did not fish with a net, but with a hook” (32). There is a debate between small–scale traditional techniques (the hook) and techniques for large–scale fishing, or industrial overfishing, which will eventually worsen the health of the sea and bring negative consequences for the people who live from it. From the epidemiological point of view, the GP has at least five reasons to go fishing with a hook and to avoid the network of massive fishing, with the problematic consequences that the latter brings (Table 2) [8, 33–37].

Table 2: The General Practitioner has at least Five Reasons "To Go Fishing with a Hook" and to Avoid the Network of "Massive Fishing".

Reasons	Concepts
1	The method in general medicine is to identify pre–symptomatic disease or screening — the fishing network. But, this is undertaken through “case–findings” — fishing with a hook. The activities of screening a cohort, where the service is offered to a selected group within the population, it is replaced for of taking advantage of the contact with the patients to offer screening to who needs it. General medicine is the ideal framework for the activities of these screenings "on hook", even the people who least motivated by prevention come to the GP when they feel ill (93 % of the patients assigned to a GP visit the surgery a minimum of once every 5 years)
2	In general medicine, the predictive negative value — the probability that a certain disease is not the cause of the patient’s problem — is more important than the predictive positive value, due to the low prevalence of disease versus the hospital context (where patients, who have been selected by GPs, arrive). Thus, in general medicine, with a low prevalence of diseases, the positive predictive value of the test, decreases and will have more false (+) and less false (–). Consequently the GP must fish with a hook.
3	The GP should take individual decisions based on Bayesian probabilities –fishing with a hook– rather than relying on the frequency probabilities offered by epidemiology and public health experts. The Bayesian approach makes things clearer. For example, if a study shows that in 100 smokers, 10 will develop lung cancer, a classical interpretation of the data can lead us think if I smoke I have a 10% probability of becoming ill. And this is not true. What the study really tells us is that the data (10 of every 100 smokers develop cancer) can be considered as a good starting point for making a prediction about the chances of developing cancer if I smoke. In contrast, a Bayesian approach would make it very clear that this is a highly incomplete knowledge, and, therefore, is not very useful without further information that raises the levels of certainty. Strictly speaking, for a Bayesian, it is incorrect to say, “I predict that there is a 10% chance of event X occurring — “lung cancer in smokers”. Rather, he/she would say, “Based on current knowledge, there is a 10% certainty that lung cancer will occur in smokers”
4	The GP has a different approach to statistical meanings (to fish with a net) and clinical meanings (to fish with a hook). If a statistical proof shows that a difference between the two measurements is significant at the 5% level ($p < 0.05$) it means that there is a 95% possibility that the difference found between treaties and controls is true and there is only a 5% possibility that the difference is due to random factors. Statistics is the method by which the effects of the chance are estimated. The statistical significance of some intervention does not always mean clinical significance and, vice versa, a non–statistically significant result can be considered significant in health. No matter how small “p” is, it does not speak of the magnitude of the differences or of clinical significance. Trivial differences may show “p” as statistically very significant if large numbers of subjects are studied. Thus the significance — the mathematical probability that the result did not occur by chance — is less relevant than the clinical significance — what the findings might mean if they were applied to a similar population
5	The GP focuses on the effectiveness (fishing with a hook), compared to the efficacy (net fishing). The evaluation of the usefulness of health measures for the target population can be carried out by considering their effectiveness (actual conditions) and efficiency (laboratory conditions). Patients in clinical trials are selected to cooperate with the intervention being evaluated. But this does not happen with ordinary patients, so that they experience lower rates of success of the intervention that those reported in clinical trials. The measure of efficiency tells us whether the treatment can work and provide more benefits than problems for those who are prescribed it under the restricted conditions of a study. Effectiveness tells us whether treatment has more advantages than disadvantages for those offered the treatment in ordinary life

The GP as a lawyer

The lawyer is an independent professional who, as a consultant and representative of a person, defends their rights and interests. The lawyer is a versatile technician who, depending on their areas of expertise, can provide services defend a person’s interests in all kinds of legal proceedings, negotiations, and drafting of all types of public and private contracts. They provide advice and brokering for all types of real estate transactions, tax advice, counselling and rights management, defence against sanctions, and so on.

The GP spends years serving the interests of their patients and relatives. He/she knows his strengths and weaknesses. Through these multiple inquiries, the doctor has established bonds of affection and commitment, always seeking the best for the patient. Thus, the GP sees beyond the medical aspects. The GP becomes an advocate for the patient and recommends solutions that are best for the patient. The GP looks for the best sub–specialist to help solve the complex problems of their patients. In this way, the GP is the patient’s advocate or social agent. GPs are engaged in their communities and can play the role of “patient advocate”, encouraging the population to have access to health, social resources, health education, and to use these resources efficiently.

The specialist doctor who is not a GP tends to work differently from the attorney. For the physician, the patient “is guilty” (it does not matter to have a mistake and to call guilty or sick to a healthy patient, that is, from an epidemiological point of view, does not mind incurring a type I error: to take for real a false positive; so giving more value to the test positive, although it may be false).

However, from point of view of the lawyer, the individual is innocent until proven otherwise (he/she prefers to err by calling "not guilty", instead to have a fault in reverse, that is, he/she prefers to incur the type II error: to take as true a false negative).

Table 3: From an Epidemiology Perspective, When the Outcome of a Clinical Trial, or A Diagnosed Test is Expressed in Dichotomous Terms (Useful or Not), There are Four Ways in Which the Conclusions Could Be Related to Reality.

		Real Difference	
		Present	**Absent**
Conclusion of Statistical Test	**Statistical difference**	CORRECT	INCORRECT (Error Type I or Alfa) (Comparable to false positive)
	No statistical difference	INCORRECT (Type II error or beta) (Comparable to false negative)	CORRECT

From an epidemiology perspective, when the outcome of a clinical trial, or a diagnosed test is expressed in dichotomous terms (for example: useful or not), there are four ways in which the conclusions could be related to reality (Table 3).

Thus, examples for the type I error would be:

1) It believes that the patient is sick, even though in reality he/she is healthy.
2) It finds the defendant guilty, even though he/she is actually innocent.

For type II error:

1) It believes that the patient is healthy, although in reality he/she is sick.
2) It argues that the accused is not guilty, even though in actually he/she is guilty.

In his role as patient advocate, the GP has to fear to the error type I, instead the type II error. From an epidemiological point of view the GP has to be more of a lawyer than a physician [8, 38–43].

Conclusion

Clinical epidemiology combines the clinical method and the epidemiological method. Clinical epidemiology, applying the terms of normality / abnormality, sensitivity and specificity of diagnostic tests, predictive values and risk estimation, to name a few, would allow the physician to make a better decision and use the most effective treatment alternative for the patient. However, the current Clinical Epidemiology can maintain a positivist tendency, with indisputable advantages in the field of epidemiological clinical research, although reductionist, especially in general medicine. Clinical knowledge is a way of understanding a set of facts and comparing clinical material. To recover a complete vision, the GP must recapture its connectivity experience with the entire plot of patients' lives. The GP should not waiting clinical epidemiology and evidence–based medicine give results beyond their potential, and he/she should adjust cautiously them to the moment and place necessary. Clinical epidemiology uses the methods of epidemiology for the purposes of clinical care activity, and its practical incorporation in the care of patients in general medicine is a great advance (Table 4). GP and the epidemiologist complement each other, but each one makes his own melody.

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None.

Conflict of interest

Author declares there is no conflict of interest.

Table 4: Metaphors that Explain the Concepts and Methods of Clinical Epidemiology Applied to General Medicine.

Metaphors	Concepts and Methods of Clinical Epidemiology Applied to General Medicine
The GP as a wizard	Contextualization, experience, continuity of care, strategic planning, emotion and intuition, ethic, clinical interview, empathy, focusing on the process rather than the outcome, etc.
The GP as a fisherman with a hook	Case–findings, predictive negative value, Bayesian probabilities, statistical significance and clinical significance, effectiveness compared to the efficacy
The GP as a lawyer	Type I and type II error

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